Verification at the DTC

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Overview

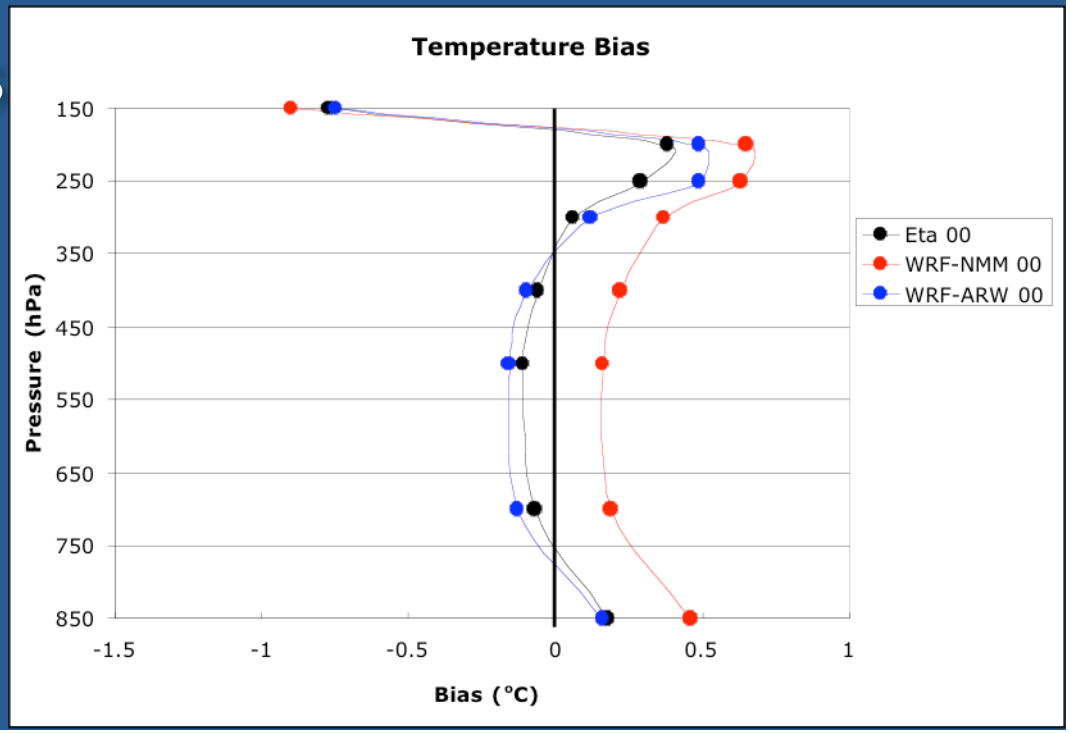
- Use of NCEP verification system
- Enhancements
  - Confidence Intervals
  - Model differences
- Development of Model Evaluation Tools (MET)
- Implementation of MET for DTC research
- Collaboration with HWT, HMT
- Future plans

Staff

Many staff members from
NOAA GSD
and
NCAR RAL / DTC
have contributed to the
DTC verification efforts.

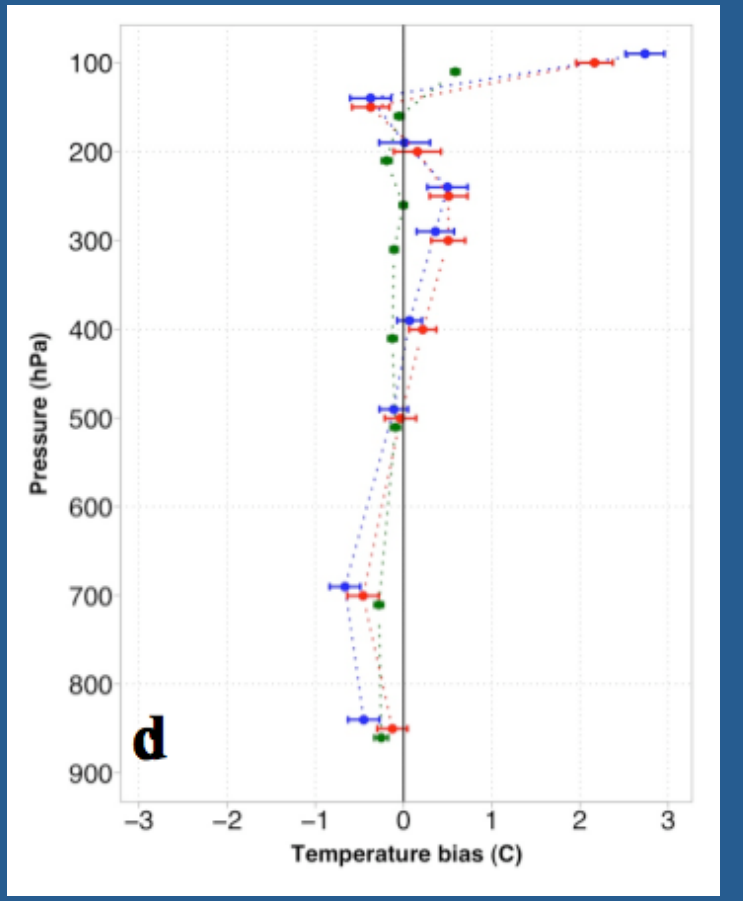
Use of NCEP verification system

- Matches up forecasts with observations.
- Computes a variety of traditional verification statistics.
- Accumulates forecasts over time.
- Lead time analysis



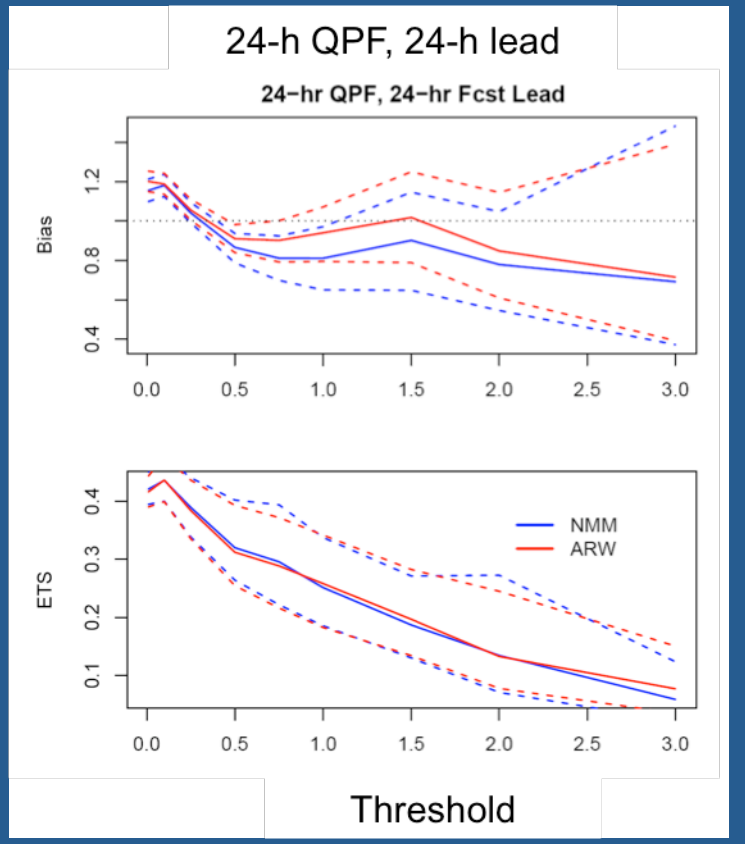
Confidence and Model Differences

- Model comparisons difficult without confidence information.
- Since models compared on same cases, make use of pair-wise nature of the comparisons.
- Develop confidence on differences in statistics between two models.



Verification research
Statistical inference

- Traditionally, most verification scores have been reported with no information about uncertainty
  - Uncertainty is related to sampling variability, observation measurement error, representativeness
- Often, selection of models has been based on very small differences in scores; small samples
- Confidence intervals and significance tests provide information about uncertainty; allow more informed decision making
- Challenges:
  - Non-normal statistics
  - Spatial and temporal correlation
  - Observation uncertainty
  - Encouraging appropriate application of confidence intervals and significance tests
  - Practical significance vs. Statistical significance

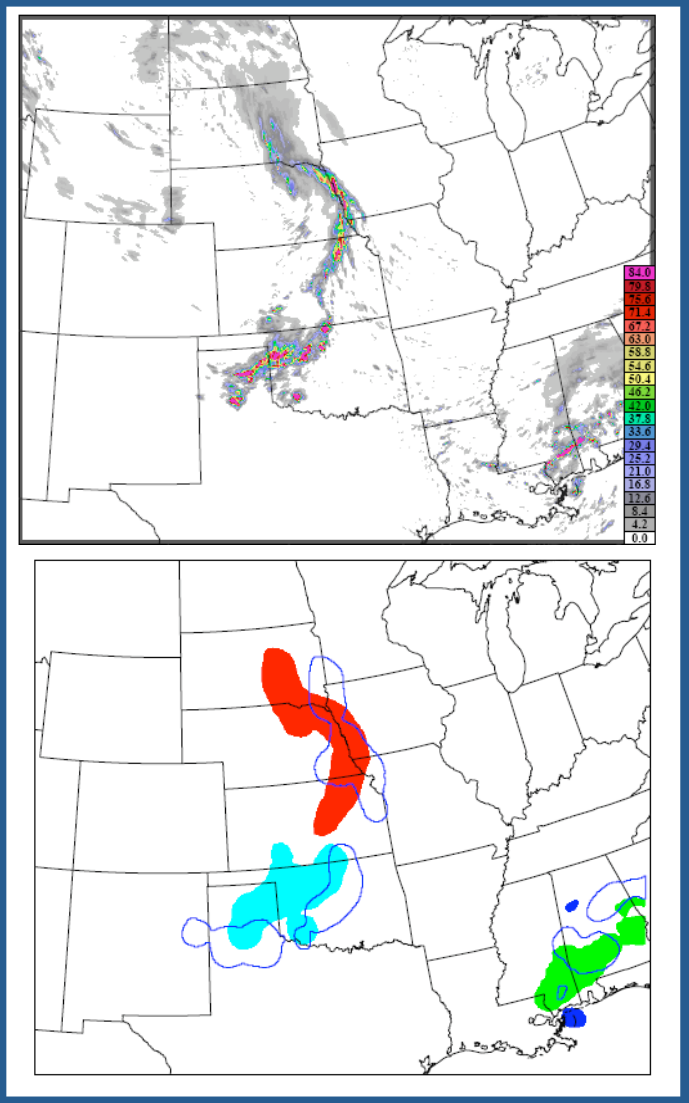


Development of Model Evaluation Tools (MET)

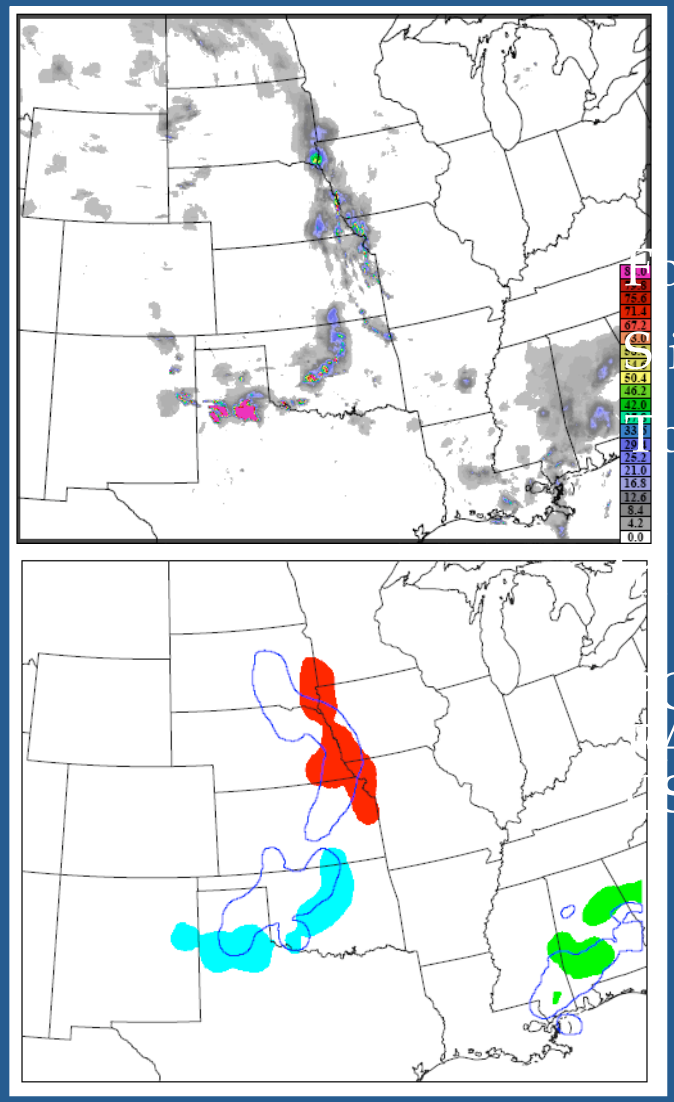
- Started with NCEP verification system as baseline.
- Additional statistics
- Probabilistic forecast verification
- Confidence intervals
- Neighborhood methods
- Object-based verification (MODE)
- Intensity scale verification via wavelets
- Documentation, web site, email help.

MODE example

24-h precip forecast



Precip analysis



MODE quantitative results indicate

orecast is good

ightly displaced

oo intense

contrast:

OD = 0.40

AR = 0.56

SI = 0.27

Spatial Method Intercomparison Project

What do the various methods measure?

Attribute	*Traditional*	*Feature-based*	*Neighborhood*	*Scale*	*Field Deformation*
Perf at different scales	Indirectly	Indirectly	**Yes**	**Yes**	No
Location errors	No	**Yes**	Indirectly	Indirectly	**Yes**
Intensity errors	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
Structure errors	No	**Yes**	No	No	**Yes**
Hits, etc.	**Yes**	**Yes**	**Yes**	Indirectly	**Yes**

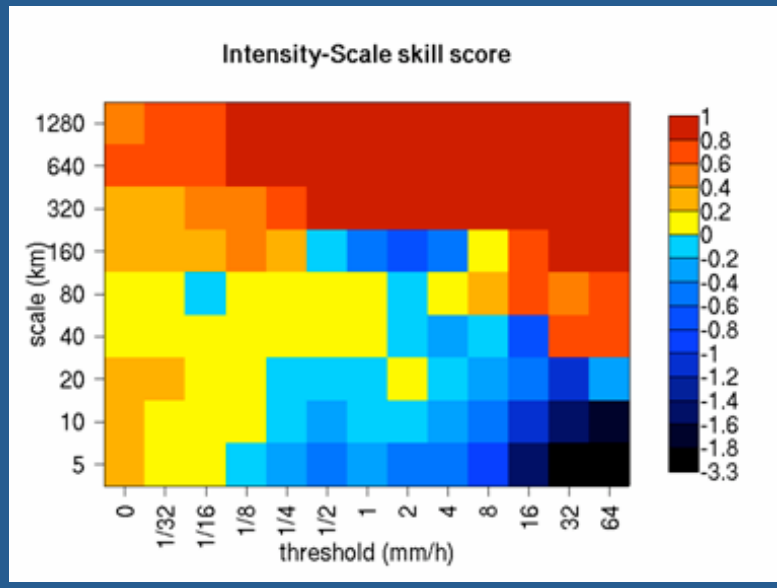
MET connections to the community

Goals:

Incorporate state-of-the-art methods contributed by the modeling, research, operational, and verification communities

Examples:

- Intensity-scale approach
- Neighborhood methods
- Graphical techniques



Outreach

- Collaborations with HWT, HMT
- Town Hall meetings at AMS, NCAR
- Workshops (2007, 2008, 2009)
  - International verification experts + NWP experts + DTC staff
  - Guidance on methods and approaches to be included
- Spatial method intercomparison project (ICP)
- DTC Visitor Program
  - M. Baldwin: Verification testbed
  - B. Casati: Intensity-scale approach
- Demonstrations

MET usage

- Initial release of MET July 2007.
- Over 300 registered users.
- Will be implemented to verify WRF for DTC tests this year.
- HWT spring experiment usage, 2008 and 2009.
- HMT usage expected beginning this fall.

2009 HWT Spring Exp May 4- Jun 5

Focus: Evaluate radar assimilation impact

Models and Obs:

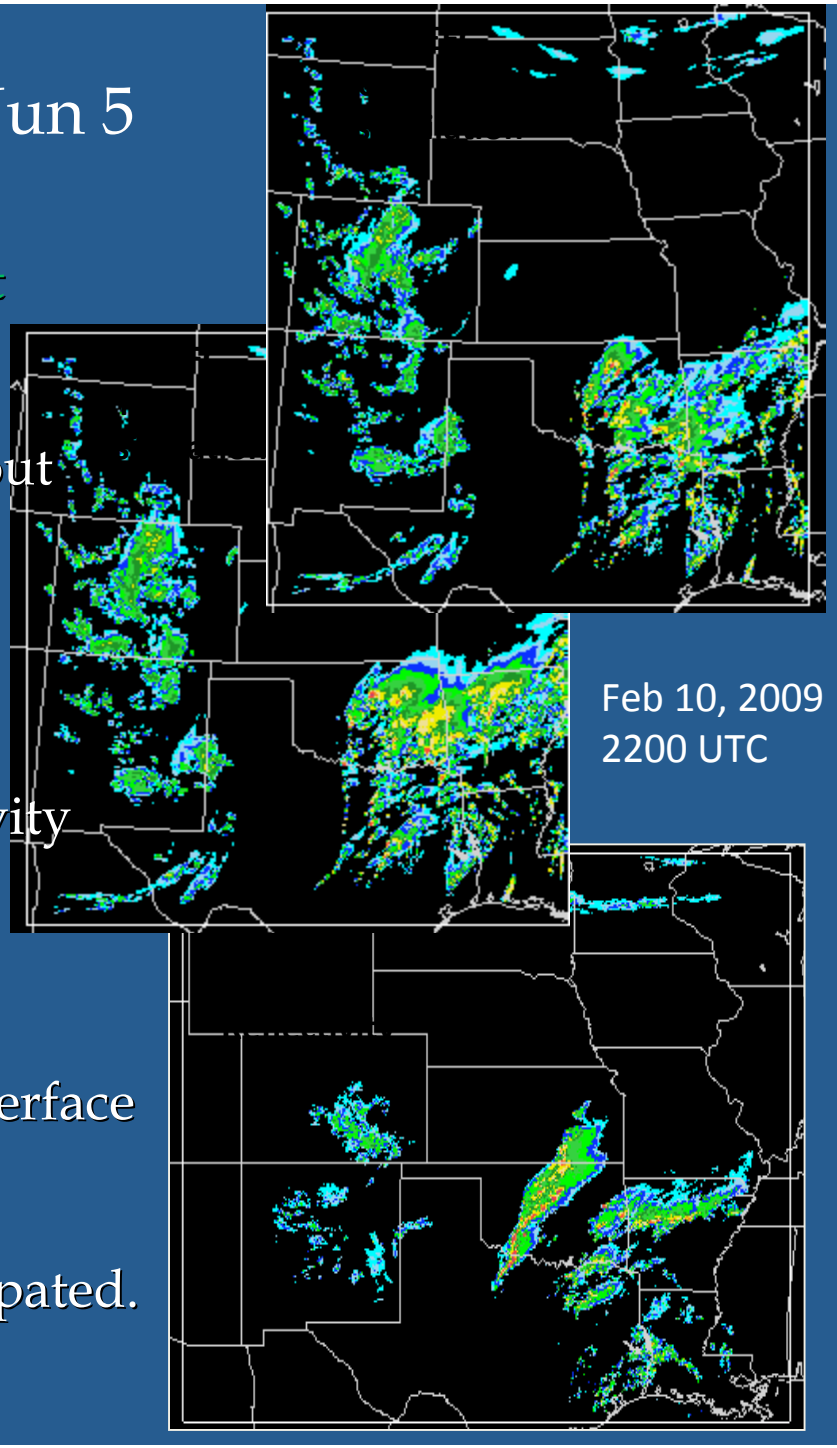
- CAPS 4 km WRF-ARW with and without radar assimilation
- NOAA High Resolution Rapid Refresh (HRRR) grids for Vortex 2
- NMQ Q2 QPE and Composite Reflectivity

Displays:

- MET real-time evaluation at DTC
- Graphical results displayed on web-interface

DTC Participation:

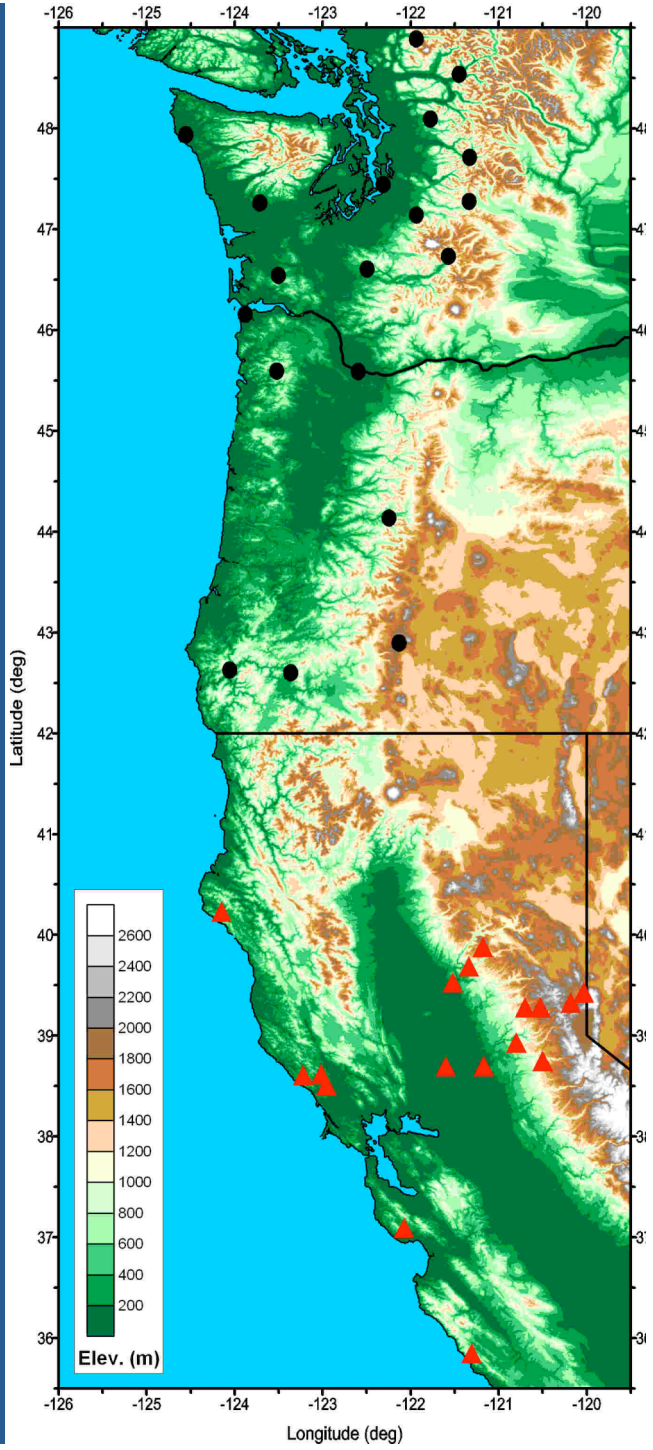
- On-site participation for 5 weeks anticipated.



Feb 10, 2009
2200 UTC

HMT Collaboration

- Verification is an initial, important area of collaboration
- Near-term goal: Implement and demonstrate existing capabilities
  - Event-based precipitation verification (varying thresholds)
  - MET traditional and spatial verification methods
  - Enhance tools to provide HMT-relevant information
- Longer-term goals: Enhance current capabilities
  - Observation uncertainty
  - Spatial verification methods for ensemble forecasts
  - Identify and implement capabilities needed for southeast region



Future Plans

- MET
  - More data formats.
  - Database and display.
  - Ensemble forecast methods.
  - Cloud verification.
- DTC verification team
  - Research new verification methods.
  - Promote use of MET.
  - Collaborate with WRF community.

Conclusions

- Verification is an essential component of the DTC mission.
- Verification is treated both as an independent scientific discipline and as a service.
- Collaborations can take advantage of either or both.